

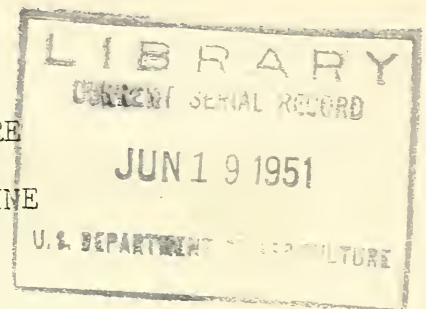
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✓ STATUS OF IMPORTED PARASITES OF THE JAPANESE BEETLE IN 1950 ✓

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This report summarizes information on the current status of some of the imported parasites of the Japanese beetle. Colonization and recovery records of the three most important species are shown in tabular form.

Five species of imported parasites of the Japanese beetle are known to have become established in the United States, but only three of these are believed to be exerting control of economic significance.

✓ Tiphia vernalis Roh.

This hymenopteron, known as the spring Tiphia, is undoubtedly the most important of the three. One of the solitary wasps, it is parasitic upon the host larva, which the female seeks out in the ground for egg deposition. The adult wasps themselves feed upon the droplets of insect-secreted honeydew to be found upon the leaves of many plants and shrubs, Norway maple being one of the favorites. The common name "spring Tiphia" was adopted because it appears during May and June and to distinguish it from T. popilliavora, a species appearing later in summer.

T. vernalis was first released in the United States in 1926. The very early releasements were comprised of foreign-collected females, together with laboratory parasitized host grubs. Except for three releasements in 1931, no releases of parasitized grubs were made after 1927, and records show that the release or "planting" of parasitized grubs is much less effective than release of adult wasps. The first releasements of field-collected females of domestic origin were made in 1931. The continual increase in the quantity of available material rendered the redistribution of field-collected females from domestic sources so advantageous from every standpoint that no foreign material of this species was imported after 1933. Records of the Bureau of Entomology and Plant Quarantine show that from 1931 to 1950 over 240,000 female T. vernalis have been collected for colonization purposes. In addition, T. vernalis have been collected and redistributed locally each year for several years by entomological agencies of several States in which the original colonization of this parasite was accomplished through the efforts of the Bureau's laboratory at Moorestown, N. J.

Effectiveness of *T. vernalis* as a factor in control of the Japanese beetle.--Since *T. vernalis* attacks the larval stage of its host, any attempt to evaluate its effectiveness on the basis of percent of parasitization must be done by soil sampling during the brief period in the spring between the disappearance of the adult parasite and emergence from the ground of the adult host. The time and labor factors render it impracticable to obtain sufficient data of this nature to be of statistical significance over large acreages. Nevertheless, five appraisal surveys were made at three locations in the general Philadelphia area from 1935 to 1939, at which times parasitization was found to vary from 36 to 61 percent. Subsequently soil surveys of an even more limited nature have been conducted at some sites in the Philadelphia area and also at more distant points in Pennsylvania, as well as in New Jersey and Virginia. Parasitization has been found to range from 13 to 61 percent, and with one or two exceptions the records show that parasitization varies with host grub abundance. Table 1 summarizes the information obtained in these surveys.

Table 1.--Summary of soil-survey results

Colony-site location	Date	Area dug, square feet	Average grubs per square feet	Total grubs recovered	Percent of grubs parasitized
Rushland, Pa.	1935	200	5.7	1,146	61
	1936	200	4.9	817	48
Philmont (Phila.), Pa.	1936	200	5.7	1,142	58
Overbrook (Phila.), Pa.*	1937	565	0.9	492	36
Rushland, Pa.	1939	200	5.3	1,054	48
Valley Forge, Pa.	1949	40	5.7	230	30
Phoenixville, Pa.	1949	40	3.9	157	19
Conshohocken, Pa. (Area 1)	1949	40	5.2	210	31
(Area 2)	1949	40	4.9	195	47
Mt. Holly, N. J.	1949	40	2.8	111	49
Arlington, Va.* (Area 1)	1950	40	0.75	30	13
(Area 2)	1950	40	1.37	55	14
Reading, Pa.	1950	40	3.4	136	20

\* Where the average population is less than 1 grub per square feet, the survey results are not considered statistically reliable.

Although *T. vernalis* was known to have been established at many of the colonization points and to have attained percentages of parasitization ranging up to 60 percent or more at these sites, comparatively little was known about its dispersion from these centers. In 1950 information was obtained on this point. During the period when adult Tiphias were flying, a survey was made of the general area in which colonies had been released in early years, including approximately 1,400 square miles in Delaware and southeastern Pennsylvania. Predetermined routes were followed and 10-minute stops made at half-mile intervals without regard to the location of



the original colonization sites. Even with brief 10-minute stops, adult parasites were observed at 86 percent of the points where stops were made. If more time had been taken at each stop, and if sweetened bait had been applied to the shrubbery and trees under observation, the parasite recovery probably would have been close to 100 percent. Several recoveries were made 7 to 10 miles beyond the established limits of the area where colony releasements were made. It is evident that the parasite has spread throughout the entire area that has been generally colonized, and it has demonstrated a capacity for unaided dispersion to considerable distances.

Compatibility of milky disease and *T. vernalis*.--The active period of parasitization by *T. vernalis* is during May and June. The Tiphia thus attacks the larval population at its lowest point, after the high milky disease mortality of the previous summer and fall. If disease is present, its development during the spring period of Tiphia activity is so slow, owing to unfavorable soil temperatures, that it does not compete seriously with *T. vernalis*. It is true that some overlapping does occur and that Tiphia will oviposit on diseased grubs, but if the disease is not in its final stages, most of the parasites will complete their development, since they are immune to the effects of the organism.

Colonization of *T. vernalis*.--A total of 2,008 colonies of this species have been distributed in 14 States and the District of Columbia through the facilities of the Bureau's Japanese Beetle Laboratory at Moorestown, N. J. In addition to these liberations several cooperating States now have their own colonization programs, using material collected within their respective boundaries. The development of this plan has relieved the Federal agency of much of the burden of local redistribution in the more recently infested areas of these States, thus permitting some of the much desired "follow up" study of the parasite's progress in regions already colonized. Table 2 gives a complete summary of all liberations and recoveries of this species, except those made independently by various States, from 1926 through 1950.

#### *Tiphia popilliavora* Roh.

This parasite, commonly referred to as the "summer Tiphia" of which there are two racial forms, may be placed second to *T. vernalis* in current importance. It also was imported from Japan and works in the same manner as *T. vernalis*, but it has a life history which is seasonally different. *T. popilliavora* is active from mid-August to early September when the majority of available host grubs are in the second instar. Since the progeny resulting from eggs laid on second-instar grubs are predominantly males, a sharply unbalanced sex ratio is common for the summer Tiphia. There have been 716 colonies of this species released in 8 States. Original establishment was very good when host grub populations were high and the proportion of suitable host grubs numerically large, but for the reasons just mentioned, the reduction in parasite abundance has been severe as the host insect was brought under control. Recent surveys of colonies released prior to 1929 showed a colony survival of 60 percent in Pennsylvania but of only 8 percent in the less heavily infested areas of New Jersey.

No liberations of this particular parasite have been made since 1944. Table 3 shows the complete data on colonization and recovery of the summer *Tiphia* through 1950.

*Tiphia popilliavora* Roh. (Korean form)

This is a racial form of the preceding species, and is referred to as the Korean form because of its geographical origin and to distinguish it from its very close relative from Japan. This form is considered separately because it emerges later in the summer and therefore is somewhat more advantageously synchronized with its host grub development. As may be seen from Table 4, a total of 51 colonies of this form of *T. popilliavora* have been released in 8 States, the latest releasement having been made in 1948.

*Centeter cinerea* Ald.

This fly is the third most important Japanese beetle parasite. It was imported from Japan where its importance as a control factor is more pronounced than in the United States. It attacks the adult beetle, upon which it lays a small light-colored egg. In the portions of our country where liberations have been made the bulk of the adult flies emerge about two weeks before the host, with the result that most of the control potential of the parasite has been dissipated before any host material is available. The fly spreads readily, mainly through the mobile character of its host. As the anticipated natural adjustment of its life history to that of the Japanese beetle occurs, or should the beetle invade geographical regions in this country where conditions favor an immediate adjustment, it could become a much more effective control factor. Forty-nine liberations have been made through 1950 in 12 States, as shown in Table 5.

*Dexia ventralis* Ald. .

This parasite fly, still in an experimental status, is also from Japan but it is quite different from *C. cinerea*. *D. ventralis* has three generations per year and is an internal parasite of the host larva. The adult females deposit living larvae which seek out and penetrate the host grubs in the ground. Unfortunately the second, or summer brood, occurs at a time when grubs of the Japanese beetle are very scarce. This serves to seriously limit the otherwise excellent control potential of this parasite. To date there is only one colony of this species known to be established--at Haddonfield, N. J.--though 17 releasements have been made in 5 States. In 1950 a recovery of the fly was made approximately 2 miles from the Haddonfield colony which was established in 1926, indicating the possibility of greater expansion than has previously been supposed. However, the species is still considered to be on an experimental basis until sufficient opportunity is afforded for testing it in the field where larvae of an alternate host species are available to second-generation flies.

*Prosenia sibirita* Ald.

Also parasitic upon the host larva is *P. sibirita*, a fly of foreign origin which, during the early years of its establishment, was believed to hold

considerable promise although it has but one generation per year. Slightly over 12,000 individuals have been released in varying numbers at 5 locations in Pennsylvania and New Jersey, but no recoveries have been recorded for several years. In Japan this fly is most abundant in regions where the Japanese beetle has a partial two-year cycle, and there is the possibility that it might be more successful in the United States if it were to be released where a similar host cycle exists. No releasements of the species have been made since 1930.



Table 2.--Liberations and recoveries of the Japanese beetle parasite *Tiphia vernalis*

State and county	Number of colonies released								Recovery from colonies over 2 years old	
	1926-35	1936-45	1946	1947	1948	1949	1950	Total 1926-50	Scouted	Recovered Percent recovered
New Jersey:										
Atlantic-----	--	2	--	--	--	--	--	2	--	--
Burlington-----	27	1	--	--	--	--	--	28	19	--
Camden-----	9	--	--	--	--	--	--	9	2	--
Cape May-----	--	2	--	--	--	--	--	2	2	--
Cumberland-----	5	1	--	--	--	--	--	6	5	--
Gloucester-----	13	--	--	--	--	--	--	13	5	--
Hunterdon-----	16	45	--	--	--	--	--	61	--	--
Mercer-----	52	--	--	--	--	--	--	52	44	--
Middlesex-----	9	15	--	--	--	--	--	24	2	--
Monmouth-----	19	--	--	--	--	--	--	19	10	--
Ocean-----	4	--	--	--	--	--	--	4	4	--
Salem-----	18	--	--	--	--	--	--	18	11	--
Somerset-----	18	49	--	--	--	--	--	67	6	--
Union-----	--	18	--	--	--	--	--	18	--	--
Morris-----	--	15	--	--	--	--	--	15	--	--
Bergen-----	--	15	--	--	--	--	--	15	--	--
Essex-----	--	4	--	--	--	--	--	4	--	--
Passaic-----	--	1	--	--	--	--	--	1	--	--
Total-----	190	168	--	--	--	--	--	358	110	47.3
Connecticut:										
Fairfield-----	--	67	--	3	--	--	--	79	3	--
New Haven-----	--	18	--	3	3	--	--	28	2	--
Hartford-----	--	27	--	--	3	6	--	33	--	--
New London-----	--	5	--	--	1	2	--	8	--	--
Middlesex-----	--	1	--	--	1	--	--	2	--	--
Windham-----	--	1	--	--	--	--	--	1	--	--
Total-----	--	119	13	6	5	8	--	151	5	100.0



Table 2.--Liberations and recoveries of the Japanese beetle parasite *Tiphia vernalis*--Continued

State and county	Number of colonies released						Recovery from colonies over 2 years old				
	1926-35	1936-45	1946	1947	1948	1949	1950	1926-50	Scouted	Recovered	Percent recovered
Delaware:											
New Castle----	11	38	--	--	--	--	--	49	5	5	--
Kent-----	--	11	--	--	--	--	--	11	6	4	--
Total	11	49	--	--	--	--	--	60	11	9	81.8
Pennsylvania:											
Montgomery----	83	31	--	--	--	--	--	114	71	54	--
Bucks-----	78	49	--	--	--	--	--	127	45	26	--
Philadelphia----	16	--	--	--	--	--	--	16	9	7	--
Delaware-----	53	1	--	--	--	--	--	54	39	24	--
Chester-----	53	113	--	--	--	--	--	166	22	17	--
Cumberland----	1	2	--	--	--	--	--	3	1	1	--
Dauphin-----	1	6	--	--	--	--	--	7	1	1	--
Lehigh-----	--	1	--	--	--	--	--	1	--	--	--
Berks-----	--	4	--	--	--	--	--	4	--	--	--
Monroe-----	--	5	--	--	--	--	--	5	3	2	--
Lancaster-----	--	20	--	--	--	--	--	20	5	2	--
York-----	--	1	--	--	--	--	--	1	--	--	--
Northampton----	--	3	--	--	--	--	--	3	1	1	--
Snyder-----	--	1	--	--	--	--	--	1	--	--	--
Westmoreland----	--	2	--	--	--	--	--	2	--	--	--
Luzerne-----	--	2	--	--	--	--	--	2	--	--	--
Lycoming-----	--	2	--	--	--	--	--	2	--	--	--
Northumberland----	--	1	--	--	--	--	--	1	--	--	--
Montour-----	--	1	--	--	--	--	--	1	--	--	--
Clinton-----	--	1	--	--	--	--	--	1	--	--	--
Allegheny-----	--	1	--	--	--	--	--	1	--	--	--
Total-----	285	247	--	--	--	--	--	532	198	136	68.7

Table 2.--Liberations and recoveries of the Japanese beetle parasite *Tiphia vernalis*--Continued

State and county	Number of colonies released							Recovery from colonies over 2 years old	
	1926-35	1936-45	1946	1947	1948	1949	1950	1926-50	Scouted Recovered Percent recovered
Massachusetts:									
Hampden-----	2	2	--	--	--	3	--	7	4 0 --
Middlesex-----	--	1	--	--	--	--	--	1	1 0 --
Worcester-----	--	1	--	--	--	1	--	2	1 0 --
Hampshire-----	--	--	--	--	--	5	--	5	-- --
Franklin-----	--	--	--	--	--	1	--	1	-- --
Total-----	2	4	--	--	--	10	--	16	6 0 0.0
New York:									
Nassau-----	1	29	--	--	--	--	--	30	2 1 --
Queens Borough--	1	8	--	--	--	--	--	9	1 1 --
Staten Island---	--	10	--	--	--	--	--	10	-- 8 --
Westchester-----	--	100	--	--	--	--	--	100	-- --
Rockland-----	--	18	--	--	--	--	--	18	-- --
Tioga-----	--	2	--	--	--	--	--	2	-- --
Chemung-----	--	2	--	--	--	--	--	2	-- --
Monroe-----	--	3	--	--	--	--	--	3	-- --
Orange-----	--	17	--	7	1	--	--	25	-- --
Dutchess-----	--	18	6	1	2	--	--	27	-- 3 --
Putnam-----	--	7	--	--	--	--	--	7	-- --
Ulster-----	--	3	--	8	3	--	--	14	-- --
Suffolk-----	--	2	--	--	6	--	--	8	-- --
Albany-----	--	1	--	--	--	--	--	1	-- --
Columbia-----	--	1	--	--	--	--	--	1	-- --
Livingston-----	--	1	--	--	--	--	--	1	-- --
Ontario-----	--	1	--	--	--	--	--	1	-- --
Saratoga-----	--	1	--	--	--	--	--	1	-- --
Tompkins-----	--	1	--	--	--	--	--	1	-- --
Schuyler-----	--	1	--	--	--	--	--	1	-- --
Seneca-----	--	--	1	--	--	--	--	1	1 --
Broome-----	--	--	2	--	--	--	--	2	-- --
Total-----	2	226	9	16	12	--	--	265	18 14 77.7

Table 2.--Liberations and recoveries of the Japanese beetle parasite *Tiphia vernalis*--Continued

State and county	Number of colonies released							Recovery from colonies over 2 years old			
	1926-35	1936-45	1946	1947	1948	1949	1950	1926-50	Scouted	Recovered	Percent recovered
<b>Rhode Island:</b>											
Providence-----	--	21	--	--	--	--	--	21	14	4	--
Washington-----	--	2	--	--	--	--	--	2	--	--	--
Bristol-----	--	1	--	--	--	--	--	1	--	--	--
Newport-----	--	1	--	--	--	--	--	1	--	--	--
Total-----	--	25	--	--	--	--	--	25	14	4	28.6
<b>Maryland:</b>											
Baltimore City-	1	3	--	--	--	--	--	4	7	6	--
Cecil-----	1	21	--	--	--	--	--	21	13	12	--
Dorchester-----	--	1	--	--	--	--	--	1	--	--	--
Frederick-----	--	6	--	--	2	--	--	8	--	0	--
Washington-----	--	1	--	--	--	--	--	1	--	--	--
Kent-----	--	45	--	--	--	--	--	45	12	8	--
Harford-----	--	46	--	--	--	--	--	46	4	2	--
Baltimore-----	--	43	--	--	--	--	--	43	4	1	--
Wicomico-----	--	2	--	--	2	--	--	4	1	--	--
Worcester-----	--	4	--	--	2	--	--	4	--	--	--
Somerset-----	--	1	--	--	--	--	--	3	1	1	--
Howard-----	--	2	--	--	--	--	--	2	3	3	--
Prince Georges-	--	3	--	--	--	--	--	3	2	2	--
Anne Arundel---	--	2	--	--	2	--	--	4	--	--	--
Queen Annes----	--	2	--	--	--	--	--	2	--	--	--
Talbot-----	--	1	--	--	--	--	--	1	--	--	--
Montgomery-----	--	--	--	1	5	--	--	6	--	--	--
Charles-----	--	--	--	--	2	--	--	2	--	--	--
Carroll-----	--	--	--	--	1	--	--	1	--	--	--
Total	2	373	--	1	16	--	--	392	44	35	79.5

Table 2.--Liberations and recoveries of the Japanese beetle parasite *Tiphia vernalis*--Continued

State and county	Number of colonies released								Recovery from colonies over 2 years old		
	1926-35	1936-45	1946	1947	1948	1949	1950	1926-50	Scouted	Recovered	Percent recovered
West Virginia:											
Taylor-----	--	2	--	--	--	--	--	2	--	--	--
Berkely-----	--	--	--	--	--	--	5	5	--	--	--
Jefferson-----	--	--	--	--	--	--	5	5	--	--	--
Total-----	--	2	--	--	--	--	10	12	--	--	--
North Carolina:											
Buncombe-----	--	1	--	--	--	--	--	1	--	--	--
Henderson-----	--	1	--	--	--	--	--	1	--	--	--
Total-----	--	2	--	--	--	--	--	2	--	--	--
Virginia:											
Arlington-----	--	4	--	--	--	--	--	4	4	4	--
Henrico-----	--	2	--	1	9	--	--	12	--	--	--
Chesterfield-----	--	2	--	1	1	--	--	4	--	--	--
Spotsylvania-----	--	2	--	--	--	--	--	2	1	1	--
Fairfax-----	--	9	11	5	--	--	--	25	1	1	--
Norfolk-----	--	1	--	--	--	--	--	1	--	--	--
Loudoun-----	--	28	12	5	3	1	--	49	--	--	--
Stafford-----	--	1	--	--	--	10	--	1	--	--	--
Prince William-----	--	--	--	--	3	--	--	13	--	--	--
Powhatan-----	--	--	--	--	1	10	--	1	--	--	--
Fauquier-----	--	--	--	--	--	10	--	10	--	--	--
Rappahannock-----	--	--	--	--	--	9	--	9	--	--	--
Clarke-----	--	--	--	--	--	7	--	7	--	--	--
Alleghany-----	--	--	--	--	--	3	--	3	--	--	--
Total-----	--	49	23	12	17	40	--	141	6	6	100.0



Table 2.--Liberations and recoveries of the Japanese beetle parasite *Tiphia vernalis*--Continued

State and county	Number of colonies released								Recovery from colonies over 2 years old		
	1926-35	1936-45	1946	1947	1948	1949	1950	1926-50	Scouted	Recovered	Percent recovered
Ohio:											
Cuyahoga-----	--	12	4	--	--	--	--	16	--	--	--
Guernsey-----	--	1	--	--	--	2	--	3	--	--	--
Mahoning-----	--	4	--	--	--	--	--	4	--	--	--
Lake-----	--	--	--	--	--	3	--	3	--	--	--
Columbiana-----	--	--	--	--	--	1	--	1	--	--	--
Total-----	--	17	4	--	--	6	--	27	--	--	--
New Hampshire:											
Cheshire-----	--	1	--	--	--	--	--	1	1	1	--
Merrimack-----	--	1	--	--	--	--	--	1	1	1	--
Strafford-----	--	1	--	--	--	--	--	1	1	0	--
Total-----	--	3	--	--	--	--	--	3	3	2	66.6
District Columbia:											
Wash. & vic.-----	1	8	--	--	--	--	--	9	8	4	--
Total-----	1	8	--	--	--	--	--	9	8	4	50.0
Vermont:											
Windham-----	--	--	--	--	--	--	11	11	--	--	--
Windsor-----	--	--	--	--	--	--	3	3	--	--	--
Rutland-----	--	--	--	--	--	--	1	1	--	--	--
Total-----	--	--	--	--	--	--	15	15	--	--	--
Grand Total-----	493	1292	49	35	50	64	25	2008	423	267	63.1

Table 3.--Liberations and recoveries of the Japanese beetle parasite *Tiphia popillivora*

State and county	Number of colonies released												Recovery from colonies over 2 years old			
	1921-30	1931-40	1941	1942	1943	1944	1945	1946	1947	1948	1949	1950	Total 1921-50	Scouted	Recovered	Percent recovered
New Jersey:																
Burlington----	44	23	--	--	--	--	--	--	--	--	--	--	67	65	30	--
Camden-----	6	3	--	--	--	--	--	--	--	--	--	--	9	9	3	--
Gloucester----	15	8	--	--	--	--	--	--	--	--	--	--	23	22	2	--
Hunterdon----	--	18	--	--	--	--	--	--	--	--	--	--	18	11	1	--
Mercer-----	2	47	--	--	--	--	--	--	--	--	--	--	49	47	16	--
Middlesex----	--	6	--	--	--	--	--	--	--	--	--	--	6	5	0	--
Monmouth-----	--	1	--	--	--	--	--	--	--	--	--	--	1	--	--	--
Salem-----	--	20	--	--	--	--	--	--	--	--	--	--	20	17	1	--
Somerset-----	--	31	--	--	--	--	--	--	--	--	--	--	31	23	5	--
Total-----	67	157	--	--	--	--	--	--	--	--	--	--	224	199	58	29.9
Pennsylvania:																
Bucks-----	27	85	--	--	--	--	--	--	--	--	--	--	112	102	57	--
Chester-----	1	27	--	--	--	--	--	--	--	--	--	--	28	23	11	--
Cumberland----	--	1	--	--	--	--	--	--	--	--	--	--	1	--	--	--
Dauphin-----	1	1	--	--	--	--	--	--	--	--	--	--	2	1	0	--
Delaware-----	14	38	--	--	--	--	--	--	--	--	--	--	52	52	39	--
Montgomery----	26	74	--	--	--	--	--	--	--	--	--	--	100	94	60	--
Philadelphia----	11	2	--	--	--	--	--	--	--	--	--	--	13	11	10	--
Total-----	80	228	--	--	--	--	--	--	--	--	--	--	308	283	177	62.5
Virginia:																
Chesterfield----	--	1	1	--	--	--	--	--	--	--	--	--	2	--	--	--
Norfolk-----	--	1	--	--	--	--	--	--	--	--	--	--	1	--	--	--
Northampton----	--	1	--	--	--	--	--	--	--	--	--	--	1	--	--	--
Henrico-----	--	--	--	--	--	3	--	--	--	--	--	--	3	--	--	--
Westmoreland----	--	--	--	--	--	1	--	--	--	--	--	--	--	--	--	--
Total-----	--	3	1	--	--	4	--	--	--	--	--	--	8	--	--	--

Table 3.--Liberations and recoveries of the Japanese beetle parasite *Tiphia popilliavora* Continued

State and county	Number of colonies released												Recovery from colonies over 2 years old			
	1921-30	1931-40	1941	1942	1943	1944	1945	1946	1947	1948	1949	1950	Total 1921-50	Scouted	Recovered	Percent
Ohio:																
Cuyahoga-----	--	--	--	--	1	--	--	--	--	--	--	--	1	--	--	--
Guernsey-----	--	--	--	--	1	--	--	--	--	--	--	--	1	--	--	--
Total-----	--	--	--	--	2	--	--	--	--	--	--	--	2	--	--	--
Maryland:																
Cecil-----	--	45	--	--	--	--	--	--	--	--	--	--	45	3	0	--
Harford-----	--	24	--	--	--	--	--	--	--	--	--	--	24	--	--	--
Kent-----	--	2	--	--	--	--	--	--	--	--	--	--	2	--	--	--
Dorchester-----	--	1	--	--	--	--	--	--	--	--	--	--	1	--	--	--
Somerset-----	--	3	--	--	--	--	--	--	--	--	--	--	3	--	--	--
Washington-----	--	1	--	--	--	--	--	--	--	--	--	--	1	--	--	--
Worcester-----	--	2	--	--	--	--	--	--	--	--	--	--	2	--	--	--
Prince Georges-----	--	3	--	--	--	--	--	--	--	--	--	--	3	--	--	--
Queen Annes-----	--	1	--	--	--	--	--	--	--	--	--	--	1	--	--	--
Caroline-----	--	1	--	--	--	--	--	--	--	--	--	--	1	--	--	--
Wicomico-----	--	1	--	--	--	--	--	--	--	--	--	--	1	--	--	--
Anne Arundel-----	--	1	--	--	--	--	--	--	--	--	--	--	1	--	--	--
Total-----	--	85	--	--	--	--	--	--	--	--	--	--	85	3	0	0.0
New York:																
Nassau-----	2	--	--	--	--	--	--	--	--	--	--	--	2	2	0	--
Queens Borough-----	1	--	--	--	--	--	--	--	--	--	--	--	1	1	0	--
Westchester-----	--	30	--	--	--	--	--	--	--	--	--	--	30	2	2	--
New York City-----	--	1	--	--	--	--	--	--	--	--	--	--	1	--	--	--
Total-----	3	31	--	--	--	--	--	--	--	--	--	--	34	5	2	40.0

Table 3.--Liberations and recoveries of the Japanese beetle parasite *Tiphia popilliavora* Continued

State and county	Number of colonies released												Recovery from colonies over 2 years old			
	1921-30	1931-40	1941	1942	1943	1944	1945	1946	1947	1948	1949	1950	Total 1921-50	Scouted	Recovered	Percent recovered
Connecticut:																
Fairfield-----	--	14	--	--	--	--	--	--	--	--	--	--	14	4	2	--
New Haven-----	1	4	--	--	--	--	--	--	--	--	--	--	5	4	3	--
Hartford-----	--	3	--	--	--	--	--	--	--	--	--	--	3	2	0	--
New London-----	--	1	--	--	--	--	--	--	--	--	--	--	1	1	0	--
Windham-----	--	1	--	--	--	--	--	--	--	--	--	--	1	--	--	--
Total-----	1	23	--	--	--	--	--	--	--	--	--	--	24	11	5	45.5
Delaware:																
New Castle-----	--	31	--	--	--	--	--	--	--	--	--	--	31	22	2	--
Total-----	--	31	--	--	--	--	--	--	--	--	--	--	31	22	2	9.1
Grand Total -	151	558	1	--	2	4	--	--	--	--	--	--	716	523	244	46.6



Table 4.--Liberations and recoveries of the Japanese beetle parasite *Tiphia popillivora* (Korean strain)

State and county	Number of colonies released												Recovery from colonies over 2 years old			
	1921-30	1931-40	1941	1942	1943	1944	1945	1946	1947	1948	1949	1950	Total 1921-50	Scouted	Recovered	Percent recovered
New Jersey:																
Camden-----	1	1	--	--	--	--	--	--	--	--	--	--	2	2	1	--
Hunterdon-----	--	4	--	--	--	--	--	--	--	--	--	--	4	4	1	--
Mercer-----	--	1	--	--	--	--	--	--	--	--	--	--	1	1	1	--
Middlesex-----	--	1	--	--	--	--	--	--	--	--	--	--	1	1	1	--
Somerset-----	--	5	--	--	--	--	--	--	--	--	--	--	5	5	1	--
Total-----	1	12	--	--	--	--	--	--	--	--	--	--	13	13	5	38.4
Pennsylvania:																
Chester-----	--	15	--	--	--	--	--	--	1	--	--	--	16	14	5	--
Delaware-----	--	1	--	--	--	--	--	--	--	--	--	--	1	1	1	--
Montgomery-----	--	3	--	--	--	--	--	--	--	--	--	--	3	3	3	--
Philadelphia-----	--	1	--	--	--	--	--	--	--	--	--	--	1	1	0	--
Total-----	--	20	--	--	--	--	--	--	1	--	--	--	21	19	9	47.4
Maryland:																
Cecil-----	--	1	--	--	--	--	--	--	--	--	--	--	1	1	0	--
Harford-----	--	--	--	1	--	--	1	--	--	--	--	--	2	2	0	--
Montgomery-----	--	--	--	--	--	--	--	--	--	2	--	--	2	--	--	--
Total-----	--	1	--	1	--	--	1	--	--	2	--	--	5	3	0	0.0
Connecticut:																
New Haven-----	--	--	--	--	--	--	1	--	--	1	--	--	2	1	0	--
Total-----	--	--	--	--	--	--	1	--	--	1	--	--	2	1	0	0.0
Delaware:																
New Castle-----	--	3	--	--	--	--	--	--	--	--	--	--	3	3	0	--
Total-----	--	3	--	--	--	--	--	--	--	--	--	--	3	3	0	0.0

Table 4.--Liberations and recoveries of the Japanese beetle parasite *Tiphia popilliavora* (Korean strain) (Cont'd)

State and county	Number of colonies released													Recovery from colonies over 2 years old		
	1921-30	1931-40	1941	1942	1943	1944	1945	1946	1947	1948	1949	1950	Total 1921-50	Scouted	Recovered	Percent recovered
Ohio:																
Mahoning-----	--	--	--	1	--	--	--	--	--	--	--	--	1	--	--	--
Total-----	--	--	--	1	--	--	--	--	--	--	--	--	1	--	--	--
Virginia:																
Henrico-----	--	--	--	--	--	--	4	--	--	--	--	--	4	--	--	--
Total-----	--	--	--	--	--	--	4	--	--	--	--	--	4	--	--	--
North Carolina:																
Buncombe-----	--	--	--	--	1	--	--	--	--	--	--	--	1	--	--	--
Henderson-----	--	--	--	--	1	--	--	--	--	--	--	--	1	--	--	--
Total-----	--	--	--	--	2	--	--	--	--	--	--	--	2	--	--	--
Grand total	1	36	--	2	2	--	6	--	1	3	--	--	51	39	14	35.9

Table 5.--Liberations and recoveries of the Japanese beetle parasite *Centeter cinerea*

State and county	Number of colonies released											Recovery from colonies over 2 years old			
	1922-31	1932-41	1942	1943	1944	1945	1946	1947	1948	1949	1950	Total 1922-50	Scouted	Recovered	Percent recovered
Pennsylvania:															
Perks-----	--	1	--	--	--	--	--	--	--	--	--	1	--	--	--
Bucks-----	2	1	--	--	--	--	--	--	--	--	--	3	3	1	--
Chester-----	--	--	--	--	--	--	1	--	--	--	--	1	--	--	--
Dauphin-----	4	--	--	--	--	--	--	--	--	--	--	4	4	0	--
Delaware-----	1	--	--	--	--	--	--	--	--	--	--	1	1	0	--
Montgomery-----	2	1	--	--	--	--	--	--	--	--	--	3	3	2	--
York-----	1	--	--	--	--	2	--	--	--	--	--	3	1	0	--
Total-----	10	3	--	--	--	2	--	1	--	--	--	16	12	3	25.0
New Jersey:															
Burlington-----	3	2	--	--	--	--	--	--	--	--	3	8	4	3	--
Camden-----	--	--	--	--	--	--	--	--	--	--	1	1	--	--	--
Hunterdon-----	--	1	--	--	--	--	--	--	--	--	--	1	1	0	--
Middlesex-----	--	1	--	--	--	--	--	--	--	--	--	1	1	0	--
Total-----	3	4	--	--	--	--	--	--	--	--	4	11	6	3	50.0
Connecticut:															
Fairfield-----	2	--	--	--	--	--	1	--	--	--	--	3	1	1	--
Hartford-----	--	1	--	--	--	--	--	--	--	--	--	1	1	1	--
Total-----	2	1	--	--	--	1	--	--	--	--	--	4	2	2	100.0
District Columbia:															
Washington-----	--	1	--	--	--	--	--	--	--	--	--	1	--	--	--
Total-----	--	1	--	--	--	--	--	--	--	--	--	1	--	--	--
Massachusetts:															
Berkshire-----	--	1	--	--	--	--	--	--	--	--	--	1	1	1	--
Bristol-----	--	--	--	--	--	--	--	--	--	1	--	1	--	--	--
Hampshire-----	--	--	--	--	--	--	--	--	--	1	--	1	--	--	--
Total-----	--	1	--	--	--	--	--	--	--	2	--	3	1	1	100.0



Table 5.--Liberations and recoveries of the Japanese beetle parasite *Centeter cinerea* Continued

State and county	Number of colonies released												Recovery from colonies over 2 years old		
	1922-31	1932-41	1942	1943	1944	1945	1946	1947	1948	1949	1950	Total 1922-50	Scouted	Recovered	Percent recovered
New Hampshire:															
Cheshire-----	--	1	--	--	--	--	--	--	--	--	--	1	--	--	--
Total-----	--	1	--	--	--	--	--	--	--	--	--	1	--	--	--
Virginia:															
Chesterfield---	--	1	--	--	--	--	--	--	--	--	--	1	--	--	--
Total-----	--	1	--	--	--	--	--	--	--	--	--	1	--	--	--
Delaware:															
Kent-----	--	--	1	1	--	--	--	--	--	--	--	2	--	--	--
Total-----	--	--	1	1	--	--	--	--	--	--	--	2	--	--	--
New York:															
Dutchess-----	--	--	--	1	--	1	--	--	--	--	--	2	1	1	--
Fishkill-----	--	--	--	1	--	--	--	--	--	--	--	1	--	--	--
Orange-----	--	--	--	--	--	1	--	--	--	--	--	1	--	--	--
Ulster-----	--	--	--	1	--	--	--	--	--	--	--	1	--	--	--
Total-----	--	--	--	3	--	2	--	--	--	--	--	5	1	1	100.0
Ohio:															
Cuyahoga-----	--	--	--	--	2	--	--	--	--	--	--	2	--	--	--
Total-----	--	--	--	--	2	--	--	--	--	--	--	2	--	--	--
Rhode Island:															
Providence-----	--	--	--	--	1	--	--	--	--	--	--	1	1	0	--
Total-----	--	--	--	--	1	--	--	--	--	--	--	1	1	0	0.0
Maryland:															
Frederick-----	--	--	--	--	--	--	--	--	2	--	--	2	--	--	--
Total-----	--	--	--	--	--	--	--	--	2	--	--	2	--	--	--
Grand Total--	15	12	1	4	3	4	1	1	2	2	4	49	23	10	43.5